Electrochemical Evaluation of the Multi-Component Insertion Cathode Mixed $LiMn_2O_4$ with $LiNi_{0.8}Co_{0.2}O_2$ for Lithium-Ion Batteries

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The obstacle to the application of $LiMn_2O_4$ is the capacity fading of this material on cycling, especially at elevated temperature. The capacity fading is caused by the dissolution of Mn^{2+} from spinel structures into the non-aqueous electrolytes and the inhomogeneity of the spinel local structure. Dissolution of Mn^{2+} can be solved by introducing some additives that can consume water or prevent acid forming in electrolyte. $LiNi_{0.8}Co_{0.2}O_2$ was expected to be a useful additive. Researchers in NEC Corporation (Japan) put a blended powder of $LiMn_2O_4$ and $LiNi_{0.8}Co_{0.2}O_2$ into a can with electrolyte and stored it at 80 °C for ten days, the results showed that both HF and Mn^{2+} concentrations were decreased with increasing $LiNi_{0.8}Co_{0.2}O_2$ blending ratio[1]. In this work, the electrochemical behavior of the multi-component cathode active materials of $LiMn_2O_4$ with $LiNi_{0.8}Co_{0.2}O_2$ were investigated by means of step potential sweep techniques at different temperature. The cycle performances of the multi-component cathode active materials were also studied.

Experimental

$LiMn_2O_4$ and $LiNi_{0.8}Co_{0.2}O_2$ powders were purchased from FMC Corporation. The mixed active material was prepared by mixing $LiNi_{0.8}Co_{0.2}O_2$ and $LiMn_2O_4$ powders in different weigh ratios, and milling in mixer for 2 hours. The test cathode preparation procedure has been described in detail [2]. Cyclic voltammetry was peroformed in a two-electrode hermetically sealed prototype cell with a Solartron SI 1287 electrochemical interface controlled by CorrWare. Data were taken at a scan rate of $\nu=0.05 mVs^{-1}$ over the potential range of 3.0 to 4.5V. The working electrode of the mixed active materials were prepared in the same manner described above .A Lithium foil served as both the counter and reference electrode. Charge-discharge studies was carried out on a battery test system at a constant current densities with the voltage limit between 3.0 and 4.3 V.

Results and discussion

Fig.1(a) and (b) show the cyclic voltammogram of the $LiMn_2O_4$ mixed with $LiNi_{0.8}Co_{0.2}O_2$ in weigh ratio of 1:1 at room temperature and 55 C, respectively.

The charge-discharge characteristics and cycle life of these mixed cathode materials were measured after the potential sweep measurement. Fig.1(c) shows the cycle behaviour.It can be seen from Fig.1(a) and (b), that the oxidation and reduction peaks of the mixed cathode material shift during cycling. There are three plateaus at 3.85 V,4.0 V and 4.2V during charge-discharge process. The effect of the addition of on the cycling and stability of at elevated temperature will be discussed.

Acknowledgements

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Reference

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